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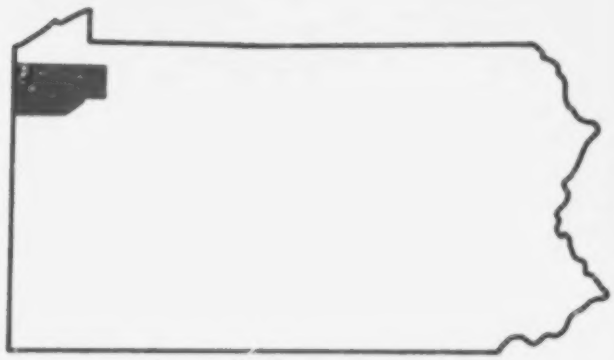
# FLOOD INSURANCE STUDY

## BOROUGH OF COCHRANTON, PENNSYLVANIA
## CRAWFORD COUNTY



JUNE 4, 1990

Federal Emergency Management Agency

COMMUNITY NUMBER - 420348

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Part or all of this FIS may be revised and republished at any time. In addition, part of this FIS may be revised by the Letter of Map Revision (LOMR) process, which does not involve republication or redistribution of the FIS. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current FIS components.

Initial Flood Insurance Study Effective Date: June 4, 1990

Flood Insurance Study Revised:

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FLOOD INSURANCE STUDY
BOROUGH OF COCHRANTON, CRAWFORD COUNTY, PENNSYLVANIA

## 1.0 INTRODUCTION

### 1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Borough of Cochranton, Crawford County, Pennsylvania, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

### 1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by the Pittsburgh District of the U. S. Army Corps of Engineers (COE) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-86-E-2226, Project Order No. 2. This work was completed in July 1988.

### 1.3 Coordination

On May 20, 1985, an initial Consultation and Coordination Officer's (CCO) meeting was held with representatives of FEMA, the borough, the Crawford County Planning Commission, and the COE (the study contractor) to determine the streams to be studied by detailed methods.

On July 6, 1989, a final CCO meeting was held with representatives of FEMA, the borough, and the study contractor to review the results of the study.

## 2.0 AREA STUDIED

### 2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Borough of Cochranton, Crawford County, Pennsylvania. The area of study is shown on the Vicinity Map (Figure 1).

The following streams were studied by detailed methods: French Creek, from the downstream corporate limits to a point approximately 0.2 mile upstream of its confluence with Little Sugar Creek, at the upstream corporate limits; and Little Sugar Creek, from its confluence with French Creek to a point approximately 0.5 mile upstream of North Franklin Street at the upstream corporate limits. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through July 1993.

### 2.2 Community Description

The Borough of Cochranton is located in southern Crawford County in northwestern Pennsylvania. It is bordered by the Township of East Fairfield to the north and west; the Township of Wayne to the east, north, and south; and the Township of Fairfield to the south and west. The borough has a land area of 1.2 square miles, and lies approximately 11 miles south of the City of Meadville. The population of the borough was 1,240 in 1980, a 0.9 percent increase from 1,229 in 1970 (Reference 1).

The climate is temperate with seasonal variation in temperature. The borough is geographically located in a region of both polar and tropical air-mass activity, and is subjected to continental and maritime invasion. The weather is generally moderate, but may have occasional rapid changes resulting from frontal air-mass movements. Temperatures range from an average of 27 degrees Fahrenheit ($^{\circ}$F) in February to an average of 71 $^{\circ}$F in July. Precipitation occurs mostly on the average of 150 days per year with an average of approximately 40 inches.

### 2.3 Principal Flood Problems

Major floods may occur on French Creek and Little Sugar Creek at various times of the year. Floods occurring in the winter months are usually the result of heavy rainfall and snowmelt. Floods in the summer months are usually the result of high-intensity, short-duration storms. French Creek is subject to considerable ice-gorging; however, the effects of this action were not considered in this study.

The largest known flood on French Creek and Little Sugar Creek within the borough occurred in January 1959. On French Creek, this flood reached an elevation of 1,059.8 feet or a gage height of 16.3

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

**BOROUGH OF COCHRANTON, PA**
**(CRAWFORD CO.)**

APPROXIMATE SCALE
2000 0 2000 4000 6000 FEET

**VICINITY MAP**

feet at the COE wire weight gage located at the State Route 173 bridge. Other known floods occurred in March 1913, April 1947, March 1960, and March 1964.

### 2.4 Flood Protection Measures

There are two flood-control dams and reservoirs upstream of the Borough of Cochranton that are effective in reducing flood levels within the borough. Union City Reservoir, completed in October 1970, is an earthen dam located on the main stem of French Creek, approximately 55 miles upstream of the borough, or at creek mile 71.5. It is a dry-bed reservoir with a capacity of 47,600 acre-feet of storage and a drainage area of 222 square miles. Woodcock Creek Lake, completed in January 1974, is on the main stem of Woodcock Creek and is located approximately 3.6 miles upstream of the mouth of Woodcock Creek. It is a multi-purpose reservoir with flood-control storage of 18,900 acre-feet in winter and 15,250 acre-feet in summer. It has a drainage area of 46 square miles. The present reservoir system reduces flood crests in the borough by approximately 1 to 3 feet. It controls approximately 27 percent of the drainage area upstream of the borough.

## 3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. A flood event of a magnitude which is expected to be equaled or exceeded once on the average during any 100-year period (recurrence interval) has been selected as having special significance for floodplain management and for flood insurance rates. This event, commonly termed the 100-year flood, has a 1 percent chance of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

### 3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

Natural discharge-frequency curves on French Creek were developed using stream gage records obtained at the U. S. Geological Survey (USGS) gaging station at Utica (No. 3024000) and the COE gage at Meadville. Continuous recording gage records at the USGS gaging station at Utica are available from August 1932 to the present. The COE has maintained numerous staff, chain, or wire weight gages on French Creek at Meadville and in the basin for varying periods of time since April 1908. Records of stream gages on French Creek at Meadville have been collected at the National Weather Service staff gage since October 1937. This gage, however, was not considered in the analysis. The historical flood records for the French Creek gaging stations were analyzed using the standard log-Pearson Type III analysis as outlined by Bulletin 17B (Reference 2). Flood flow frequencies developed for French Creek were modified by means of an average reduction curve to reflect the reduction in drainage area by the upstream flood-control reservoirs. No gage or historical flood flow records are available for Little Sugar Creek. Frequency flood flows were originally developed during the preparation of the Flood Plain Information Report for the Borough of Cochranton (Reference 3).

A summary of the drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

| FLOODING SOURCE AND LOCATION | DRAINAGE AREA (sq. miles) | PEAK DISCHARGE (cfs) 100-YEAR |
|---|---|---|
| FRENCH CREEK | | |
| At downstream corporate limits | 990.0 | 33,000 |
| Upstream of confluence with Little Sugar Creek | 935.0 | 29,000 |
| LITTLE SUGAR CREEK | | |
| At confluence with French Creek | 53.0 | 7,600 |

### 3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections were field surveyed during the preparation of the Flood Plain Information Report for the Borough of Cochranton (Reference 3). All bridges were field surveyed to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1) and the Flood Insurance Rate Map (Exhibit 2) where applicable.

Water-surface elevations of floods of the selected recurrence intervals were computed using the COE 22-J2-L212 step-backwater computer program (Reference 4). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations on French Creek were selected from a stage-discharge rating curve developed at a point approximately 0.5 mile downstream of the Crawford county boundary. The rating curve was drawn using high-water marks and was extended graphically. On Little Sugar Creek, starting water-surface elevations were based on critical depth. The results of the water-surface computations are tabulated for the selected cross sections for each stream segment (Table 2).

Channel roughness factors (Manning's "n") used in the hydraulic computations for French Creek were based on the verification of roughness requirements to reproduce profiles for known floods for which high-water marks were obtained and flow quantities were measured or easily calculated. The channel "n" values for French Creek ranged from 0.035 to 0.040, and the overbank "n" values ranged from 0.050 to 0.080; the well-defined floods of March 1913, January 1959, March-April 1960, and March 1970 were successfully reproduced using these channel and overbank "n" values. For Little Sugar Creek, channel roughness factors were chosen on the basis of field inspection. The channel "n" value for Little Sugar Creek was 0.040, and the overbank "n" value was 0.060.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 3).

## 4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100-year floodplain boundaries to assist communities in developing floodplain management measures.

| FLOODING SOURCE | | STREAM CHANNEL | | | LEFT OVERBANK | | | RIGHT OVERBANK | | | 100 YEAR FLOOD WATER SURFACE ELEVATION FT (NVGD) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE | WIDTH (FT) | DISCHARGE (CFS) | MEAN VELOCITY (FT/SEC) | WIDTH (FT) | DISCHARGE (CFS) | MEAN VELOCITY (FT/SEC) | WIDTH (FT.) | DISCHARGE (CFS) | MEAN VELOCITY (FT/SEC) | |
| French Creek | | | | | | | | | | | |
| A | 17.33[1] | 255 | 12,282 | 3.40 | 245 | 576 | 0.73 | 1,920 | 20,142 | 1.27 | 1,058.88 |
| B | 17.61[1] | 213 | 18,989 | 5.94 | 1,085 | 14,011 | 1.88 | -- | -- | -- | 1,060.08 |
| C | 18.31[1] | 236 | 24,172 | 5.74 | 188 | 747 | 1.19 | 844 | 8,081 | 1.63 | 1,061.85 |
| D | 18.36[1] | 236 | 23,458 | 5.40 | 188 | 890 | 1.13 | 844 | 8,652 | 1.60 | 1,062.40 |
| Little Sugar Creek | | | | | | | | | | | |
| A | 194[2] | 150 | 4,759 | 4.46 | -- | -- | -- | 288 | 2,841 | 2.20 | 1,062.70 |
| B | 1,039[2] | 105 | 4,323 | 7.70 | 815 | 1,769 | 1.92 | 1,190 | 1,509 | 1.61 | 1,062.70 |
| C | 1,778[2] | 115 | 7,600 | 13.07 | -- | -- | -- | -- | -- | -- | 1,063.40 |
| D | 1,990[2] | 84 | 6,520 | 9.87 | 400 | 479 | 1.75 | 260 | 601 | 1.79 | 1,067.18 |
| E | 3,521[2] | 132 | 7,120 | 8.03 | 142 | 480 | 2.19 | -- | -- | -- | 1,074.08 |

[1]Stream distance in miles above the mouth.
[2]Stream distance in feet above confluence with French Creek

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF COCHRANTON, PA
(Crawford County)

# REGULATORY DATA

FRENCH CREEK, LITTLE SUGAR CREEK

## 4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. For the streams studied in detail, the 100-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000 with a contour interval of 10 feet (Reference 5).

The 100-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zone AE). Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

## 4.2 Floodways

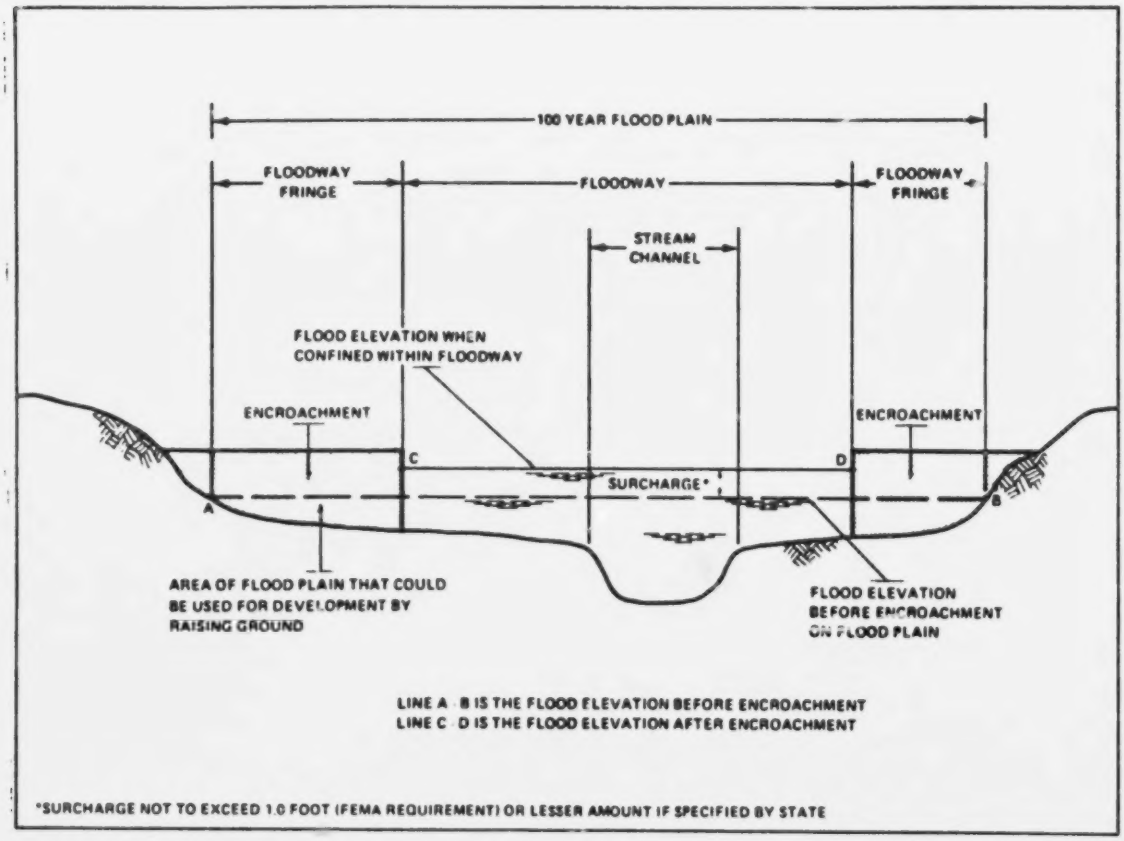
Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

No floodways were calculated as part of this study.

# 5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. The zones are as follows:


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

**FLOODWAY SCHEMATIC**

Figure 2

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, and to areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

## 6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100-year floodplain. The locations of selected cross sections used in the hydraulic analyses are shown where applicable.

## 7.0 OTHER STUDIES

A Flood Plain Information Report has been prepared for the Borough of Cochranton (Reference 3). Due to changes in flow quantities as a result of the upstream flood-control structures, discrepancies exist between the results of this study and the results of the Flood Plain Information Report for the Borough of Cochranton.

Flood Insurance Studies are currently being prepared for the Townships of Wayne, Fairfield, and East Fairfield (References 6, 7, and 8). The results of those studies will be in exact agreement with the results of this study.

## 8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting FEMA, the Natural and Technological Hazards Division, Liberty Square Building (Second Floor), 105 South Seventh Street, Philadelphia, Pennsylvania 19106.

## 9.0 BIBLIOGRAPHY AND REFERENCES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2. U. S. Department of the Interior, Geological Survey, Office of Water Data Collection, Interagency Advisory Committee on Water Data, "Guidelines for Determining Flood Flow Frequency," Bulletin 17B, Reston, Virginia, Revised September 1981.

3. U. S. Army Corps of Engineers, Pittsburgh District, Flood Plain Information Report: French Creek, Cochranton, Crawford County, Pennsylvania, Pittsburgh, Pennsylvania, September 1971.

4. U. S. Army Corps of Engineers, Hydrologic Engineering Center, Computer Program 22-J2-L212, Backwater Program, Davis, California, June 1967.

5. U. S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 10 Feet: Cochranton, Pennsylvania, 1967, Photorevised 1973.

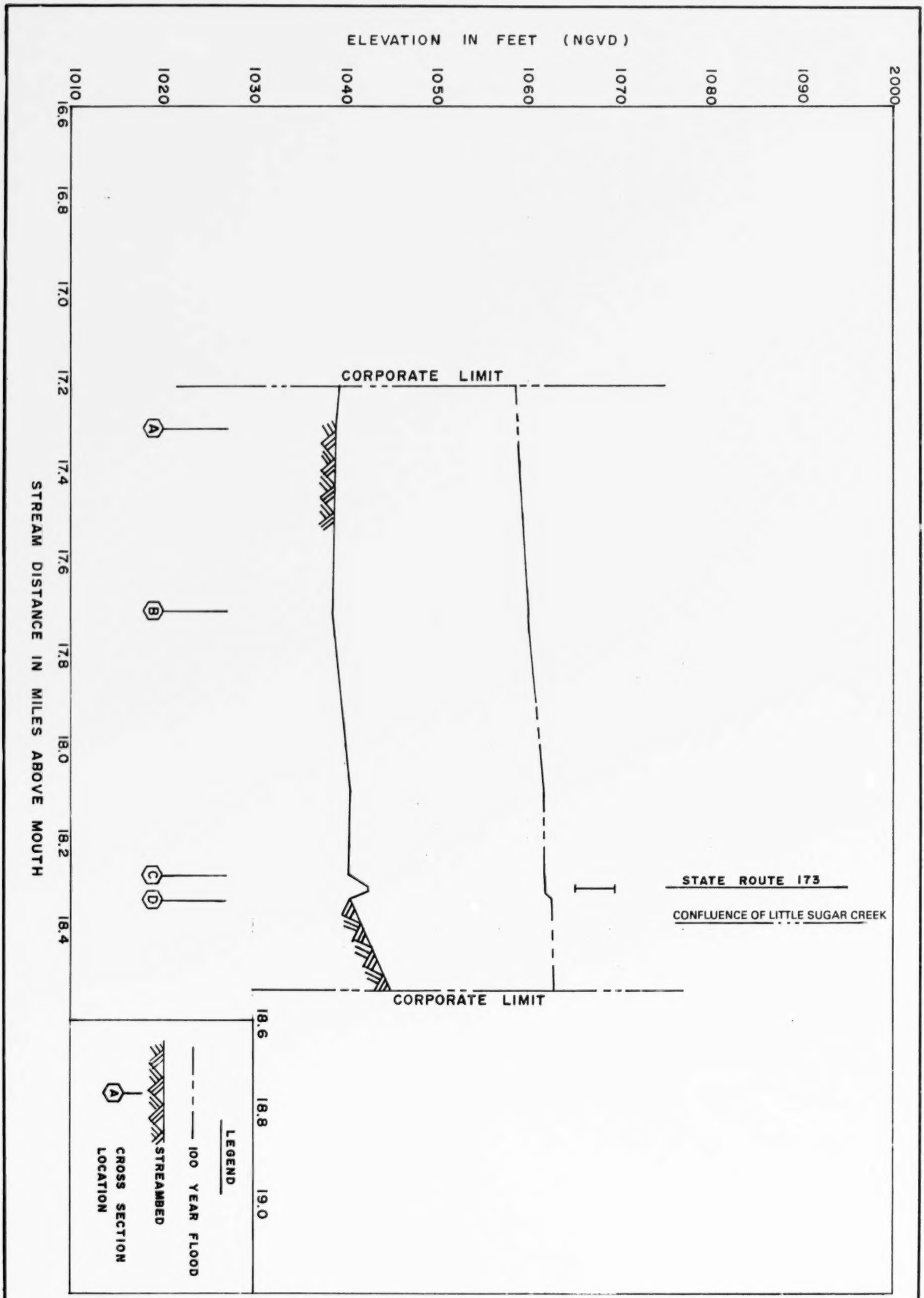
6. Federal Emergency Management Agency, Flood Insurance Study, Township of Wayne, Crawford County, Pennsylvania (Unpublished).

7. Federal Emergency Management Agency, Flood Insurance Study, Township of Fairfield, Crawford County, Pennsylvania (Unpublished).

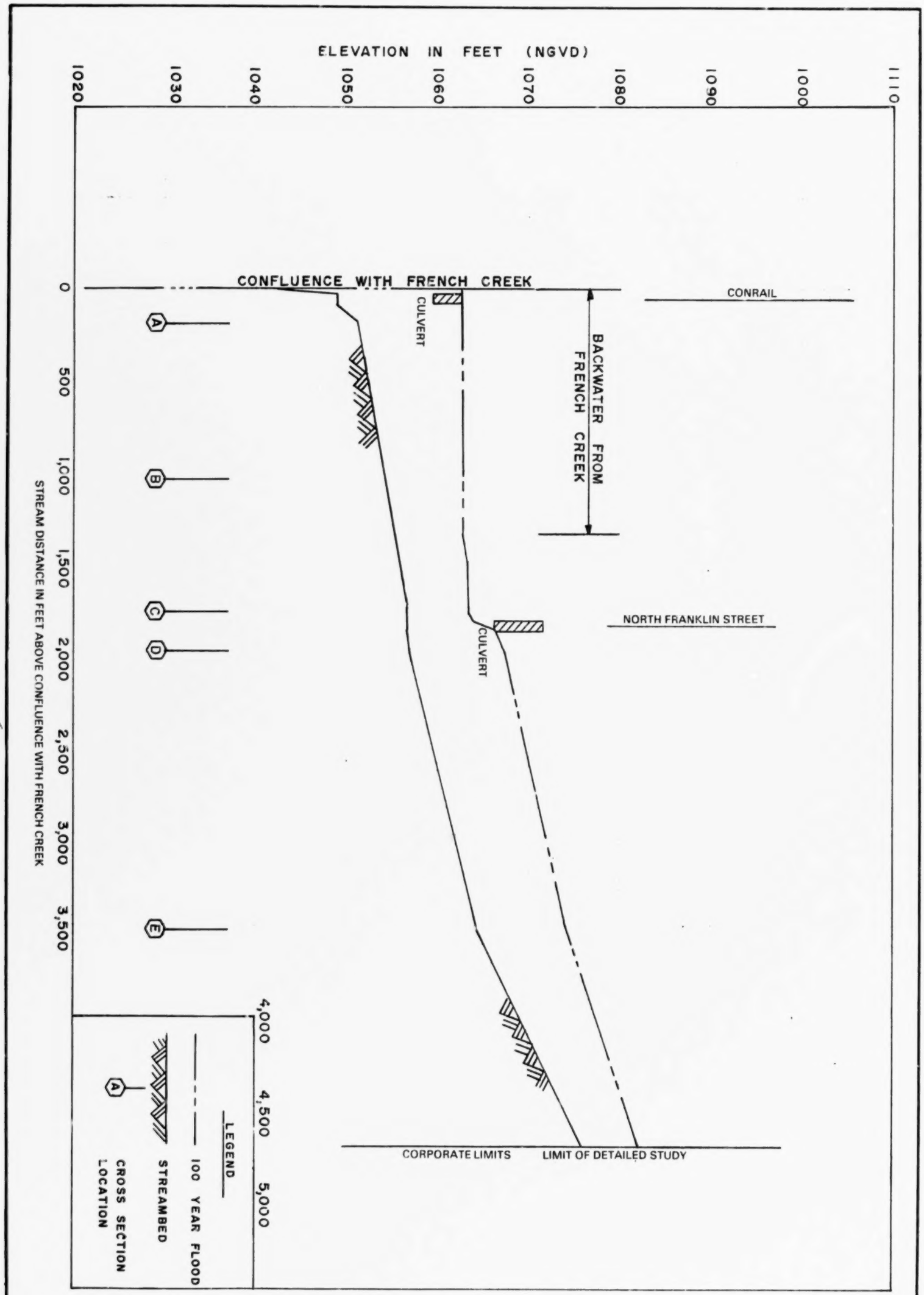
8. Federal Emergency Management Agency, Flood Insurance Study, Township of East Fairfield, Crawford County, Pennsylvania (Unpublished).

EXHIBIT 3 - ELEVATION REFERENCE MARKS

| Reference Mark | Elevation (Feet NGVD) | Description of Location |
|---|---|---|
| RM 1 | 1,119.64 | PDOT disk, stamped P323 1967, set in top of southeast end of northeast curb of U. S. Route 322 bridge over Little Sugar Creek, approximately 16 feet northeast of centerline of highway, approximately 0.5 foot northwest of southeast end of curb and approximately 1 foot above level of highway. |
| RM 2 | 1,059.98 | USGS standard disk, stamped 1062 Pittsburg 1899, in east end of north backwall, approximately 11 feet east of CONRAIL and approximately 3 feet below top of CONRAIL bridge over mouth of Little Sugar Creek. |
| RM 3 | 1,057.60 | USC&GS standard disk, stamped B 85 1935, in east side of south bridge seat, approximately 14 feet east of CONRAIL and approximately 5 feet below top of CONRAIL bridge over mouth of Little Sugar Creek. |
| RM 4 | 1,068.72 | USC&GS standard disk, stamped A 85 1935, on State Route 173 over French Creek, on south end of east backwall, approximately 15 feet south of centerline of highway and approximately 8 inches higher than highway. |




| | | |
|---|---|---|
| 01P | FEDERAL EMERGENCY MANAGEMENT AGENCY<br>BOROUGH OF COCHRANTON, PA<br>( CRAWFORD COUNTY ) | FLOOD PROFILES<br>FRENCH CREEK |

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02P

**FEDERAL EMERGENCY MANAGEMENT AGENCY**

**BOROUGH OF COCHRANTON, PA**

( CRAWFORD COUNTY )

**FLOOD PROFILES**

**LITTLE SUGAR CREEK**